Using Video and Paper–Based Educational Resources to Teach Common Surgical Techniques to Pre–Clerkship Medical Students: Results from a Simulation–Based Training Workshop

Tianshu Angela Ji[1], Sonia Butterworth[2,3]
Citation: UBCMJ. 2019: 11.1 (16-18)

Abstract

Objective: To evaluate how a one–time simulation–based workshop impacted the ability of pre–clerkship medical students to perform necessary technical skills required for surgical rotations, and to assess the effectiveness of paper and video educational resources.

Methods: This is a cohort pilot study that included 12 second–year medical students from the University of British Columbia. Participants were recruited via email and randomly assigned to either the video or paper–based educational resource. Students were educated on three common surgical techniques (Foley catheterization, sterility, and nasogastric tube insertion) and performed each task under supervision. Assessors were experienced clinicians who were blinded to the students' education resource group.

Results: All students agreed or strongly agreed that the simulation–based resources were useful for their learning. Participants from both groups reported increased confidence in performing all tasks after the workshop. The video resource group consistently performed better than the paper group according to the Adapted Global Rating Scale for Assessment of Technical Skills (Foley catheterization: 2.6 vs 2.0; nasogastric tube insertion: 3.6 vs 3.5; sterile techniques: 4.2 vs 3.9 for video and paper, respectively). More students were rated as "ready to perform independently" from the video group than from the paper group (67% vs 17%).

Conclusions: We found that simulation–based video resources were superior to paper resources in facilitating learning of practical surgical techniques. Further studies in this area are required to validate our findings.

Introduction

The transition from classroom–based to clinically–based learning can be fraught with challenges and stress for students.[1-4] This transition requires students to adapt to new learning environments, develop a professional identity, acquire increasing amounts of medical knowledge, and work long hours while studying for examinations.[1,4-6] Amongst other challenges, learners are expected to perform technical procedures at the appropriate standard despite having little to no prior experience.

At the end of medical school, students are assumed to be proficient at performing various tasks and skills taught in clerkship rotations. However, it is challenging for students to observe and master all the required procedures due to a number of constraints. These include work hour limitations, a growing amount of new medical knowledge that students are expected to learn, and changes in patient safety standards leading to fewer teaching opportunities.[7] Furthermore, despite efforts to standardize learning, student experiences will inevitably vary depending on learner–specific traits, clinical preceptors, hospital settings, and patient cases.[8] This makes it difficult to ensure that all learners have observed and retained a standard set of basic surgical skills.

In response to the changing learning environment, simulation–based training (SBT) is emerging to be an effective training tool to teach skills uncoupled from a stressful clinical environment.[7,9] Current literature from nursing shows that SBT supports psychomotor development, improved student satisfaction and confidence, and increased knowledge acquisition compared to traditional teaching methods.[10] Specifically for surgical training, numerous studies with general surgery residents showed that technical skills transferred well from the simulated, low–pressure environment into clinical practice.[9] In recent years, there has been a shift to incorporate SBT into both undergraduate medical education and residency training.[7,11] We propose that there is a role for SBT in teaching common surgical skills to undergraduate medical students.

The purpose of this pilot study was to provide pre–clerkship students with the opportunity to learn and practice three procedures required for surgical rotations. During this process, we also wanted to assess the effectiveness of our student–created simulation–based educational resources. Moreover, we wanted to assess the quality of our study protocol to inform future studies in this area. We hypothesized that all students would benefit from the workshop in terms of skill–building and confidence in performing tasks.

Materials and Methods

Learning Materials

In 2016, student investigators consulted with educators from the Department of Surgery at the University of British Columbia (UBC) to create a list of mandatory clinical skills that were not often seen or performed by medical students. In collaboration with the simulation lab at BC Children's Hospital and the input of numerous educators, students created educational videos and readings on five different procedures: nasogastric (NG) tube insertion, wound dressing, staples placement and removal, sterile technique, and Foley catheterization. These educational materials were created to instruct students with little to no experience on how to perform simple surgical tasks and were intended to be accompanied by hands–on practice with patient simulators.

Although paper–based resources provided more background information on the procedures, the instructional content on how to prepare and carry out the tasks between the paper– and video–based resources were identical. Illustrations embedded in paper–based resources were screenshots taken from the videos. All of these resources can be found at https://ubcsimulationproject.wordpress.com/.

Due to resource constraints—namely space limitations in the simulation lab, a lack of available assessors, time restraints, and a lack of funding—we focused on three procedures that had the greatest

[1]MD Program, Faculty of Medicine, UBC, Vancouver, BC, Canada
[2]Practicing Surgeon, British Columbia Children's Hospital
[3]Clinical Professor, Department of Surgery, UBC

Correspondence to
Angela Ji (Tianshu.ji@alumni.ubc.ca)

degree of complexity: male Foley catheterization, NG tube insertion, and sterile technique.

Recruitment

Medical students who completed their first or second year of medical school at UBC were invited to participate. Invitations were sent via an online registration form, and enrolment occurred on a first–come–first–serve basis. Assessors were clinicians (a general surgeon, a surgical fellow, and a nurse) recruited from BC Children's Hospital. All participants provided written consent for their participation.

In June 2017, a total of 12 students participated in this study (Table 1). It was deemed by the BC Children's Hospital's ethics board that this educational evaluation project did not require ethics approval.

Table 1 | Student Demographics (n=12).

Year of Training	Completed 1st year	100% (12)
Interest in Surgery	No	8% (1)
	Yes	25% (3)
	Maybe	67% (8)
Prior Experience in Performing task	Male Foley	0%
	NG	0%
	Sterile Techniques	25% (3)

Study Methodology

Students were blinded to the hypothesis and randomly assigned to the paper or video group. Due to time constraints, participants were allotted ten minutes to review the resource material and ten minutes to perform the task under supervision. Simulators were used so that students could obtain hands–on practice with Foley catheterization and NG tube insertion while they were evaluated by assessors. After completing each task, participants obtained immediate feedback from a clinician and subsequently provided their own written evaluation of the learning experience. This cycle was repeated until all participants had a chance to review and perform the three procedures.

Assessment

Student participants completed the Student Feedback Form (Appendix A) after performing each task. This feedback form included questions about participant demographics (Table 1), a series of statements ranked on a five–point Likert scale, and two open–ended questions.

Assessors were experienced clinicians who were familiar with the techniques. They were aware that two groups existed but were blinded to the students' allocation. Each assessor completed a written Assessor Feedback Form (Appendix B) immediately after the student performed the task. This feedback form consisted of a checklist of the main steps involved in each procedure and an adapted Global Rating Scale for Assessment of Technical Skills.[12] The Global Rating Scale was originally created to assess residents' performance in the operating room and was modified to omit sections on team communication and laparoscopic procedures.

Analysis

All quantitative analyses were carried out on Microsoft Excel. We obtained the mean and standard deviation for all numerical data. Further statistical analysis was omitted due to sample size limitations.

Qualitative analysis was conducted based on open coding and thematic analysis. Data collected from students' written feedback were independently coded by two investigators in order to increase inter–rater reliability. The initial codebooks revealed 63% agreement in themes. The investigators subsequently discussed discrepancies in the qualitative themes until consensus was reached.

Results

All participants were students who had completed their first year of medical school (Table 1). The majority of participants (92%) were definitely or possibly considering surgery as a future career choice. None of the students had any experience with Foley catheterization and NG tube insertion, while only one student in the paper group and two students in the video group had prior experience with operating room sterility.

Quantitative Results

Eleven participants (92%) reported increased confidence in performing all three tasks after the workshop. Table 2 shows students' self–reported assessment from pooled data collected on all three procedural techniques; although both groups agreed that the simulation workshop was a valuable educational experience, video resources were better received on all aspects. Subgroup analysis showed that lower ratings for paper resources were often attributed to lower scores given to the male Foley catherization station. Students found this handout to be too lengthy for the ten–minute time restriction and less valuable of an experience compared to the other tasks.

Assessors rated students from both groups similarly in terms of technical skill but felt that more individuals in the video group could perform tasks independently compared to participants in the paper group (67% vs 17%, Table 3).

Table 2 | Students' Feedback on Educational Resources (Pooled Data from All Tasks).
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree

	Paper Group (6) Mean	Video Group (6) Mean
Content		
I was confident in performing the task **before** being exposed to the educational resource	1.2 SD 0.43	1.3 SD 0.59
I was confident in performing the task **after** being exposed to the educational resource	3.3 SD 0.96	3.4 SD 0.86
The module was an effective educational tool	3.5 SD 1.15	4.2 SD 0.71
The content was at an appropriate level	3.9 SD 0.83	4.4 SD 0.62
The content was relevant to my training	4.3 SD 0.59	4.6 SD 0.51
Study Material		
The study material effectively informed me about the subject	3.6 SD 0.98	3.9 SD 0.80
The material was presented in an acceptable manner	3.6 SD 0.92	4.2 SD 0.71
This material was too simple	1.9 SD 0.73	2.0 SD 0.49
This material will prove useful to my cohort	4.2 SD 0.62	4.6 SD 0.51
The study material was of a reasonable length	3.8 SD 1.22	4.6 SD 0.51
Overall		
Overall, this simulation module was a valuable educational experience	4.2 SD 0.73	4.6 SD 0.51

Qualitative Results

Overall, students in the paper group stated that paper handouts for all three tasks were presented in a clear and organized manner. However, students wanted more images or an accompanying video to better visualize the procedures. Some participants were unable to complete the readings in ten minutes while other students commented that the

material was of an appropriate length for the time provided.

Students in the video group stated that the material was concise, organized, informative, and presented in a clear fashion. For the most part, students did not feel that improvements were needed. Some participants from the video group commented that they wanted more background information and further explanation about how different procedures would be applied to clinical practice.

Table 3 | Assessor Feedback of Students Based on Resource Group (Pooled Data from All Tasks).
*From NG and Male Catheter tasks only.

	Paper Group	Video Group
Global Scale (/5)	3.1	3.5
Readiness to Perform Independently*	17%	67%
Procedural technique	81%	87%

Discussion

Overall, students seemed to benefit from a single exposure to an SBT workshop on common surgical techniques, and most students (92%) became more confident in performing all three tasks. The majority of our participants agreed that the learning resources included appropriate and relevant topics that were of a reasonable length. Student feedback also revealed the importance of a visual component as participants consistently rated video resources to be more effective than paper resources (Table 2). Furthermore, students assigned to the paper group frequently commented that they would prefer having more pictures or an accompanying video in order to enhance their learning. Since the instructional content of both resources was identical, our findings suggest that the video format was more effective at teaching procedural skills compared to the paper format. However, we acknowledge that students' learning styles may have affected this finding.

There has been an increased movement towards the integration of electronic resources into undergraduate medical education, including the use of computer–based clinical examinations, mobile technology in cadaver labs, and multimedia resources in teaching clinical skills.[13-15] However, there is conflicting evidence on the efficacy of video–based educational resources compared to conventional paper– or lecture–based training. For example, Todd *et al.* showed that video self–instruction for cardiopulmonary resuscitation was superior to a standard American Heart Association Heartsaver course,[16] whereas Rogers *et al.* found no difference in medical students' ability to learn and perform surgical knots between video–based teaching and a lecture–and–feedback seminar.[17] It is difficult to synthesize the evidence given heterogenous interventions and varying degrees of participant skill.

In this study, more students from the video group were objectively rated "ready to perform independently" compared to the paper group (67% vs 17%) despite similar ratings in technical skill. This implied that students from the video group were perceived to be more confident in performing newly taught skills than those from the paper group. One possible explanation is that students from the video group may have been faster or less hesitant because they had the benefit of visualizing the procedures.

Limitations

A major limitation is our small sample size, which restricted our ability to prove statistical significance between groups. Student participants who volunteered for this study were also more surgically inclined, thus we did not have a representative sample of pre–clerkship students. However, this student population is more likely to participate in SBT workshops and would be the target audience for these training sessions.

Additionally, we did not evaluate student performance in the clinical setting to determine if skills were efficiently transferred. Assessors recruited for our study were also aware that two study groups existed; however, allocation concealment mitigated their potential biases when evaluating students. Lastly, the effectiveness of both formats as learning resources may be hindered by the arbitrary ten–minute limit that students were given to review the learning resource.

Future Considerations

We were unable to have a control group with no exposure to simulation–based educational materials, nor did we have a combined resource group with access to both video and paper resources. We recommend incorporating these groups into future studies if a larger sample can be obtained. Alternatively, we recommend using a cross–over design where participants rotate through both video and paper resource stations in order to mitigate the effect of learner–specific traits. We also suggest that future studies should follow student participants into their clerkship years in order to evaluate if similar workshops affect student confidence and competency in clinical practice.

We recognize that SBT is very resource intensive. At the moment, UBC's medical school does not have SBT sessions for common procedural techniques. For sustainability, we suggest that SBT would be best incorporated into the undergraduate medical curriculum.

Conclusion

To our knowledge, this is the first study to examine and trial simulation–based educational resources for common technical skills on pre–clerkship medical students. Despite the flaws in our research design, we believe our study is the first step in filling this research gap.

We found that simulation–based educational resources could be an effective way to teach mandatory clinical skills to pre–clerkship students. The majority of students reported improved confidence in performing new skills, and experienced clinicians rated up to 67% of participants as being able to perform independently after a single SBT workshop. Our findings also suggest that video format was more effective than paper format. Further research on the effect of SBT in pre–clerkship students and on the optimal modality for SBT materials is needed.

References

1. Radcliffe C, Lester H. Perceived stress during undergraduate medical training: a qualitative study. *Med Educ.* 2003;37:32 8.
2. Morrison J, Moffat K. More on medical student stress. *Med Educ.* 2001;35:617 8.
3. Moss F, McManus IC. The anxieties of new clinical students. *Med Educ.* 1992;26:17 20.
4. Dornan T, Bundy C. What can experience add to early medical education? Consensus survey. *Brit Med J.* 2004;329:834 7.
5. Pitkala KH, Mantyranta T. Professional socialization revised: medical students' own conceptions related to adoption of the future physician's role—a qualitative study. *Med Teach* 2003;25:155 60.
6. Godefrooij MB, Diemers AD, Scherpbier AJ. Students' perceptions about the transition to the clinical phase of a medical curriculum with preclinical patient contacts; a focus group study. *BMC Med Educ.* 2010;10(28):6920e10 28.
7. Acton R. The evolving role of simulation in teaching surgery in undergraduate medical education. *Surg Clin N Am.* 2015;95:739 50.
8. Muratore S, Kim M, Olasky J, Campbell A, Acton R. Basic airway skills acquisition using the American College of Surgeons/Association for Surgical Education medical student simulation–based surgical skills curriculum: initial results. *Am J Surg.* 2017;213:233 7.
9. Tsuda S, Scott D, Doyle J, Jones DB. Surgical skills training and simulation. *Curr Probl Surg.* 2009;46(4):271e370.
10. Cant RP, Cooper SJ. Use of simulation–based learning in undergraduate nurse education: An umbrella systematic review. *Nurse Educ Today.* 2017;49:63 71.
11. Scott DJ, Pugh CM, Ritter EM, Jacobs LM, Pellegrini CA, Sachdeva AK. New directions in simulation–based surgical education and training: validation and transfer of surgical skills, use of nonsurgeons as faculty, use of simulation to screen and select surgery residents, and long–term follow–up of learners. *Surgery.* 2011 Jun;149(6):735 44.
12. Doyle JD, Webber EM, Sidhu RS. A universal global rating scale for the evaluation of technical skills in the operating room. *Am J Surg.* 2007;193:551 5.
13. El Shallaly GE, Mekki AM. Use of computer–based clinical examination to assess medical students in surgery. *Educ Health.* 2012;25(3):148 52.
14. Mayfield CH, Ohara PT, O'Sullivan PS. Perceptions of a mobile technology on learning strategies in the anatomy library. *Anat Sci Educ.* 2013;6:81 9.
15. Thomas RE, Crutcher R, Lorenzetti D. A systematic review of the methodological quality and outcomes of RCTs to teach medical undergraduates surgical and emergency procedures. *Can J Surg.* 2007 Aug;50(4):278 90.
16. Todd KH, Braslow A, Brennan RT, Lowery DW, Cox RJ, Lipscomb LE, *et al.* Randomized controlled trial of video self–instruction versus traditional CPR training. *Ann Emerg Med.* 1998;31:364 9.
17. Rogers DA, Regehr G, Yeh KA, Howdieshell TR. Computer–assisted learning versus a lecture and feedback seminar for teaching a basic surgical technical skill. Am J Surg. 1998;175:508 10.